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Soviet Tin Industry:
Recent Developments and Prospects Through 1980

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SOVIET TIN INDUSTRY:
RECENT DEVELOPMENTS AND PROSPECTS THROUGH 1980

SUMMARY AND CONCLUSIONS

1. The USSR is both a leading world producer and an importer of tin. Although production has increased steadily, raising the Soviet share of world output from 8% in 1965 to about 11% in 1975, imports have regularly accounted for 20%-30% of domestic consumption.

2. During 1966-75, tin use increased steadily in the USSR, whereas consumption in many other large industrialized countries fell or remained virtually unchanged. Increasing Soviet domestic demand for production of brasses, bronzes, babbitts, and solders has driven a steady growth in use. In contrast, in most other industrialized countries the principal application for tin is in manufacture of tinplate—a product principally used in the food processing sector. A reduction in use of tin in the developed West reflects both the adoption of new tin-plating technology and the substitution of relatively cheaper forms of packaging.

3. Soviet dependence on imported tin is not likely to change substantially in the remainder of the 1970s. Although the USSR plans further increases in production, it has given no sign of a major effort to attain self-sufficiency, and it continues to participate in the International Tin Council as a tin consumer rather than as a producer.

4. The USSR produces tin at a substantial cost disadvantage in order to pursue noneconomic objectives. In 1975, allocation of 1.5 rubles worth of resources to gold production would have financed the import of more than twice as much tin as could have been produced domestically for the same input. Nevertheless, Soviet planners continue to regard tin production as justifiable to attain a high degree of self-sufficiency and desired regional development.

5. Unlike many industrialized countries, Soviet demand will continue to grow during the remainder of the 1970s. Increased domestic demand for tin will stem from growth in the canning industry, continued use of inefficient methods of tin plating that require more tin than is the case with methods employing modern technology, limited availability of substitutes for tin in industrial applications, and the present low level of per capita use.

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6. The Soviets have shelved indefinitely projects to develop new deposits in Magadan and Yakutskaya because of concern about costs in these rigorous northern regions. As a possible lower cost alternative to these projects, however, the USSR has done experimental work on offshore deposits of tin in the extreme North. Some initial success has been reported, but it is not clear yet whether Moscow is willing to invest large sums to conduct operations on a commercial scale. The USSR also is investigating promising new deposits near the route of the new Baykal-Amur Mainline (BAM) Railroad now under construction. Significant production from these deposits is, however, not likely until after completion of the BAM in the 1980s. Development of deposits in Central Asia also is being considered, but no definite plans have been formulated.

DISCUSSION

Introduction

7. The Soviet Union is the second largest producer and the fifth largest importer of tin, a commodity widely used in tinplating, solders, babbitts, bronzes, and brasses. Although world production of tin is small in comparison with other nonferrous metals (for instance, 200,000 metric tons for tin versus 13.2 million tons for aluminum and 8.3 million for copper), it is important. The United States, the leading world consumer of tin, is now and will remain for the foreseeable future dependent on foreign sources to meet part of its requirements and, therefore, is vitally interested in the future behavior of the world tin market. The Soviet Union, as an important producer and importer of tin, could have a significant influence on that market. This study was undertaken as building block research to shed light on such possible influence. It reviews the performance of the Soviet tin industry over the past decade and examines possible future trends in production, consumption, and imports through 1980.

Production and Costs

8. The USSR ranks second among world producers of primary tin,[1] although its estimated output of 25,000 tons in 1975 was less than one-third that of Malaysia, the leading world producer. Its share of world output rose from 8% in 1965 to 11% in 1975 (see Table 1).

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[1] Primary tin is obtained from the smelting and refining of ores that have been upgraded by various concentration methods. Tin obtained from recycling of scrap metal is known as secondary tin. Mined tin, which is commonly referred to as "tin-in-concentrates," is the tin content of concentrates prior to further processing into primary tin.

Table 1

Production of Primary Tin in the World and Selected Countries

		World	Of which						
			Bolivia	China	Indonesia	Malaysia[1]	Thailand	United Kingdom	USSR[2]
1965	Thousand metric tons	177	3	12	1	74	6	17	14
	Percent	100	2	7	1	42	3	10	8
1970	Thousand metric tons	212	Negl	10	5	91	22	22	21
	Percent	100	Negl	5	2	43	10	10	10
1971	Thousand metric tons	221	7	13	9	87	22	23	22
	Percent	100	3	6	4	39	10	10	10
1972	Thousand metric tons	226	7	13	12	91	22	21	22
	Percent	100	3	6	5	40	10	9	10
1973	Thousand metric tons	223	7	15	15	82	23	20	23
	Percent	100	3	7	7	37	10	9	10
1974	Thousand metric tons	218	7	15	15	84	20	12	24
	Percent	100	3	7	7	39	9	6	11
1975	Thousand metric tons	218	7	18	18	83	17	12	25
	Percent	100	3	8	8	38	8	6	11

1. In addition to smelting and refining its own mined tin, Malaysia produced primary tin from imported concentrates.
2. Excluding small amounts of primary tin produced by smelting and refining concentrates imported from Bolivia. Estimates shown above, based on fragmentary information concerning output in important producing areas, are about 6,000 tons less than annual estimates of the US Bureau of Mines published in ***Minerals and Materials/a monthly survey***, August 1976, p. 14.

9. Soviet tin ores, which are mined in the East Siberian and Far Eastern regions, undergo preliminary processing and concentrating at the mine sites before being shipped to reduction plants for final processing into primary tin. The principal reduction plant is at Novosibirsk in West Siberia, where a wide variety of tin-bearing materials, including low-quality concentrates, are processed. Facilities are available for roasting, leaching, smelting, and refining to yield a "super-pure" tin (99.9% tin content and higher) for special applications. Relatively small amounts of concentrates are also shipped to two other reduction plants at Podol'sk and Ryazan in the vicinity of Moscow (for locations and description of principal tin enterprises, see the Appendix).

10. In comparison with other domestically produced metals, Soviet tin production is a relatively high cost activity. In 1975 it would have taken 1.5 rubles worth of resources allocated to domestic production of tin to earn US$1 in hard currency, whereas it would have taken only 0.42, 0.51, and 0.68 rubles worth of magnesium, titanium, and gold, respectively, to earn the same dollar. With the exception of gold the erratic swings in world prices of nonferrous metals since 1970 have not markedly changed the relative cost disadvantage of tin in the rankings. (Table 2 compares ruble/dollar ratios for selected Soviet nonferrous metals.) The USSR could make considerable savings if resources were diverted away from tin

production to production and export of other metals in order to finance imports of tin. For example, 1.5 rubles worth of gold would have financed the import of more than twice as much tin in 1975 as could have been produced domestically with the same expenditure.[2]

Resources and Their Exploitation

11. The USSR has published no quantitative data concerning the size of its reserves of tin. Considering the current level of Soviet production and the number of known deposits, however, reserves are undoubtedly substantial. Moreover, the Soviets claim that some deposits currently being worked are large enough to support operations for decades. Additional deposits are under development, and still other promising ones are being evaluated for future use.

Table 2

Ruble/Dollar Ratios for Selected Soviet Nonferrous Metals[1]

	1970	**1975**
Magnesium	0.96	0.42
Titanium	1.07	0.51
Gold	3.47	0.68
Zinc	1.83	0.72
Aluminum	1.04	0.75
Nickel	1.31	0.83
Copper	0.60	0.87
Tin	2.80	1.50
Lead	2.17	1.59

1. In calculating the ratios, transportation costs were excluded because they constitute only a small portion of total costs. The ruble/dollar ratios relate ruble production costs to the dollar price on world markets. They are derived by dividing the Soviet wholesale price by the international price.

12. As suggested by the discussion of relative costs, above, Soviet reserves of tin, although extensive, are costly to develop and exploit. About 70% of Soviet tin is mined from lode deposits, mainly by expensive underground methods. (In contrast, about 80% of the tin production in non-Communist countries is obtained from less costly placer deposits.[3]) Placer deposits account for only about one-fifth of Soviet output. Another 10% is derived from the processing of polymetallic ores in the western USSR.

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[2] Relative costs among tin enterprises vary widely within the industry. In 1967, when the USSR last revised its wholesale prices for nonferrous metals, an average profit of 15% on reproducible fixed assets was established for all nonferrous sectors. Although the tin metal wholesale price of 10,268 rubles per ton went unchanged, revisions were made in wholesale prices at the extracting and concentrating stages in an attempt to more evenly distribute profitability among various elements of the industry. Nevertheless, as with the old wholesale prices, profitability varies sharply among tin ore mining and concentrating enterprises under the new wholesale prices. With the old arrangement, profitability ranged from losses of 15% to profits of nearly 44%; with the new it ranges from losses of 8% to profits of 52%.

[3] Placer ores are normally mined by surface methods, and, although they have a lower tin content than lode ores, they have fewer impurities and are therefore easier to concentrate.

13. Soviet costs are relatively high because important deposits are located in the remote Northern Mining Regions of Magadan Oblast and the Yakutskaya ASSR,[4] where mining activities are hampered much of the year by permafrost and freezing temperatures. During the worst months, operations are suspended. Operating conditions in the Southern Mining Regions of Siberia–Khabarovskiy and Primorskiy Krays and Chita Oblast–are not as unfavorable, but exploitation of deposits, principally lode ores, is difficult because of their location in mountainous regions.

14. Because of remoteness and harsh weather in all of these areas, large wage differentials are required to attract workers. Other costs, such as those for equipment maintenance and for transportation of materials and supplies, are also relatively high, especially in the North.

15. The major Soviet effort to develop, exploit, and prospect for tin resources has been made in the South, mainly in Khabarovskiy and Primorskiy Krays. A promising deposit has been discovered at Badzhal in Khabarovskiy Kray along the projected route of the BAM Railroad.

Northern Mining Regions

16. Magadan Oblast is one of the leading tin mining areas (see Table 3), accounting for more than one-fifth of Soviet output. In recent years, however, Magadan's production has increased slowly. Most of the increase in output from 3,800 tons in 1965 to 5,500 tons in 1975 was achieved by 1968. The principal mining center is at Pevek.

Table 3

USSR: Mined Tin Production, by Major Region

Thousand Metric Tons

	1965	1975
Total	**14.0**	**25.0**
Chita Oblast	1.9	2.6
Khabarovskiy Kray	2.7	5.5
Magadan Oblast	3.8	5.5
Primorskiy Kray	1.6	4.9
Yakutskaya ASSR	2.6	4.0
Other	1.4	2.5

17. Yakutskaya ASSR–the other northern tin mining region–accounted for 4,000 tons, more than 15% of Soviet production in 1975. Rich placer deposits in the vicinity of Deputatskiy yielded an output of 3,000 tons, and a lode mine at Ege-Khaya accounted for the other 1,000 tons.

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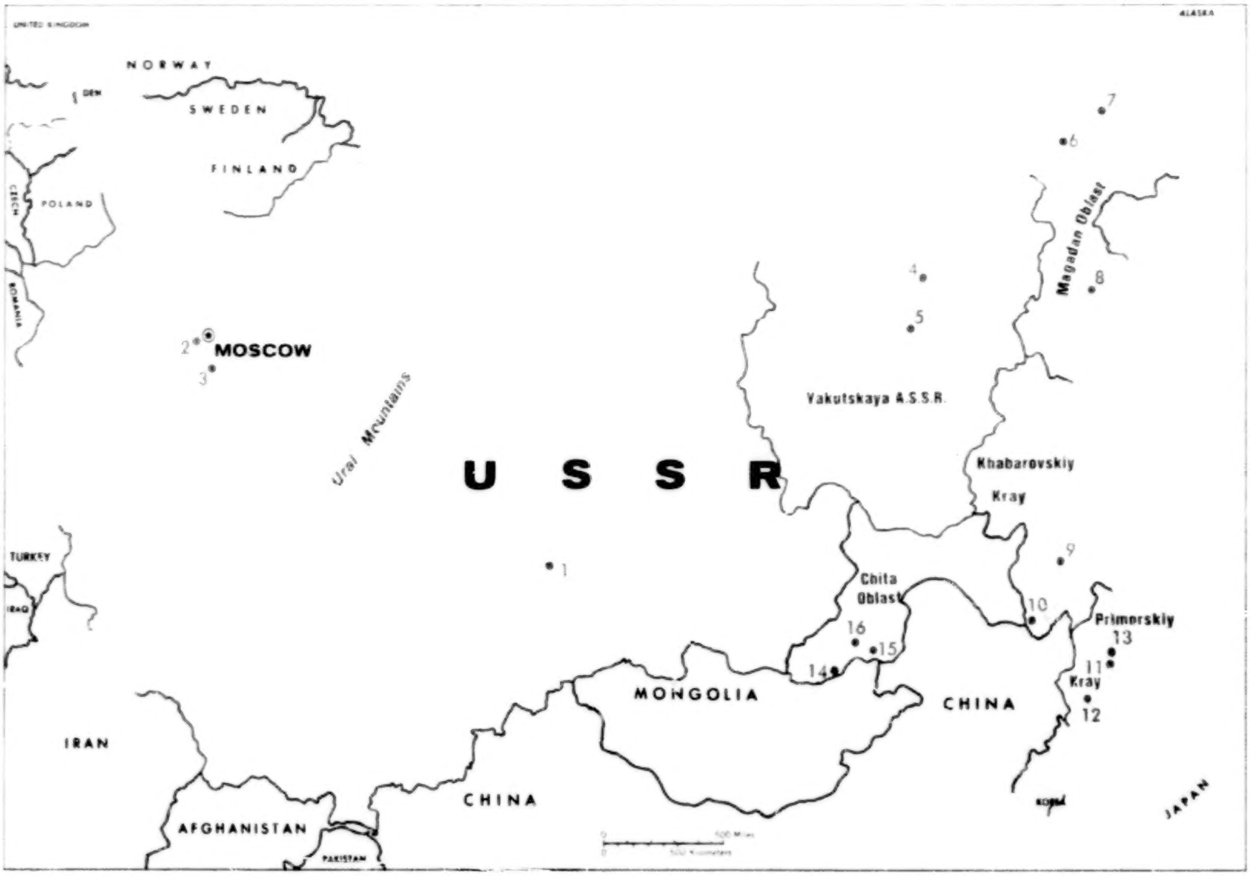
[4] Throughout this paper the term ***Northern Mining Regions*** refers to Magadan Oblast and the Yakutskaya ASSR, and ***Southern Mining Regions*** refers to Khabarovskiy Kray, Primorskiy Kray, and Chita Oblast (see the Map).

USSR: Principal Tin Facilities



1. Novosibirsk Nonferrous Metals Plant
2. Podol'sk Tin Plant
3. Ryazan Tin Plant
4. Deputatskoye Mining Administration
5. Ege-Khaya Ore Mining Combine
6. Pevek Mining & Concentrating Combine
7. Iul'tinsky Ore Mining Combine
8. Omsukchanskiy Tin Mining Combine
9. Solnechnyy Mining & Concentrating Combine
10. Khingan Tin Combine
11. Khrustalnyy Mining & Concentrating Combine
12. Dal'olovo Tin Combine
13. Sikhate-Alinskiy Polymetallic Combine
14. Khapcheranginskiy Tin Combine
15. Sherlovogorskiy Mining & Concentrating Combine
16. Ononskoye Mining Administration

Southern Mining Regions

18. Khabarovskiy Kray now rivals Magadan Oblast as the leading producer of mined tin in the USSR. During 1966-75 its output more than doubled. Tin is obtained from lode mines at Solnechnyy and Obluch'ye. The Solnechnyy facility, which the USSR credits as its lowest cost producer, had an output in 1975 of about 3,700 tons. Intensive prospecting has resulted in the discovery of new ore bodies in recent years, and development work on two new mines is nearing completion. Operations at the Obluch'ye complex yielded an output of 1,800 tons in 1975. Development work is under way on a new mine near the complex.

19. Primorskiy Kray ranks as the fastest growing tin mining region. During 1966-75 its output tripled, reaching an estimated 4,900 tons by 1975. The major share of the tin produced in Primorskiy Kray is accounted for by the Khrustal'nyy plant, which produced about 3,500 tons of tin in 1975. The capacity of the facility was enlarged by an unknown amount by completion of the Arsen'yev mine in 1975. Additional lode mining operations are carried out in Primorskiy Kray at Dal'niy and Tetyukhe, with each providing approximately 700 tons of output in 1975.

20. Chita Oblast is the oldest of all Soviet tin mining regions. In 1975 it produced 2,600 tons of tin, or about 10% of national output. Tin is obtained from lode mine operations in this oblast at Khapcheranga, Sherlovaya Gora, and Olovyannaya.

Consumption

21. The USSR is a major user of primary tin–35,000 tons in 1975–accounting for about 17% of world consumption, a level exceeded only by the United States.

22. Soviet consumption per capita in 1975, however, was about two-thirds that of the United States and other leading industrialized countries. In the past decade, however, per capita consumption of tin has increased steadily in the USSR. Because of changing technology and relative prices for close substitutes, per capita consumption has changed little or trended downward in most of the other industrialized countries.[5] Comparative trends in per capita consumption of primary tin during 1965-75 are shown in Table 4.

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[5] The recent dropoff in use of primary tin by Western countries is directly related to the recession-weakened demand, especially in the transportation, electrical, construction, and other consumer durable industries that are highly sensitive to business activity. For example, in the United States, where tin consumption declined from 59,100 tons in 1973 to 42,700 tons in 1975, expenditures on durable goods (in constant dollars) decreased from $235 billion to $204 billion. (Demand for tinplate also fell off but somewhat later than demand for tin for other uses.)

Table 4

Consumption of Primary Tin in the USSR and Selected Non-Communist Countries

	USSR	United States	Japan	West Germany	France	United Kingdom
Total	Thousand Metric Tons					
1965	19.8	59.5	17.4	11.8	10.3	19.6
1966	20.0	61.2	18.9	10.9	10.5	18.7
1967	22.4	58.8	20.7	10.8	10.9	17.6
1968	25.1	59.8	22.6	11.3	9.5	17.4
1969	26.4	58.7	25.9	13.4	10.7	18.1
1970	30.3	53.9	24.7	14.1	10.5	17.0
1971	28.1	52.8	29.3	14.2	10.5	16.4
1972	26.8	54.4	32.3	14.4	11.0	14.6
1973	29.8	59.1	38.7	15.8	11.7	16.6
1974	30.6	52.4	33.8	14.5	11.7	14.5
1975	35.0	42.7	28.1	12.0	10.0	12.4
Per capita	Kilograms per Person					
1965	0.09	0.31	0.18	0.20	0.21	0.36
1966	0.09	0.31	0.19	0.19	0.21	0.34
1967	0.10	0.29	0.20	0.18	0.22	0.32
1968	0.10	0.30	0.22	0.19	0.19	0.32
1969	0.11	0.29	0.25	0.22	0.21	0.33
1970	0.13	0.26	0.24	0.23	0.21	0.31
1971	0.11	0.25	0.28	0.23	0.20	0.29
1972	0.11	0.26	0.30	0.23	0.21	0.26
1973	0.12	0.28	0.35	0.25	0.23	0.29
1974	0.12	0.25	0.31	0.24	0.22	0.26
1975	0.14	0.20	0.25	0.20	0.19	0.22

23. The relatively stable per capita use of tin in the industrialized countries (excluding Japan, where the economy was booming) is explained mainly by factors affecting the use of tinplate. In most developed countries, tinplate remains the principal application for tin, usually accounting for more than 40% of total use, but growth in the use of tinplate has been curtailed by the adoption of new tin-saving technology in tin-plating, by the substitution of relatively cheaper containers in the packaging industry, and by new methods of food processing. Aluminum and tin-free steel are being used to an increasing extent as well as enameled steel, glass, paper, and plastics. In addition to direct substitution of other materials, new methods of food processing–frozen, dried, and freeze dried–reduce the need for all types of metal containers. Although such tin substitution methods are used most extensively in the United States, as relative costs change they are gaining increasing acceptance in other countries. The rudimentary nature of the Soviet food processing and marketing industry, coupled with extensive use of glass bottles and jars, has led to relatively limited use of tin containers for food and beverages. In part, this may be

due to difficulty in producing suitable tin containers. In any case, only 20% of Soviet tin use is in the form of tinplate, compared with 40% in most developed countries.

24. Economies in the use of tin in the manufacture of tinplate also were achieved in the West during the past decade. The continuous electrolytic tinning method, which was first adopted in 1937 and was in wide use by the mid-1960s, was nearly exclusively used in industrialized countries by the early 1970s. It requires only one-third as much tin per unit of surface area covered as the old hot dip method predominently used in the USSR. Although all new tinning facilities introduced in the USSR are electrolytic, hot dipping still accounts for two-thirds of Soviet tinplate production.

25. The USSR's steadily increasing use of tin mostly reflects the predominance of industrial applications other than tinplate. Seventy percent of total use of tin in the Soviet economy is in combination with other metals to produce solders, babbitts, bronzes, and brasses.[6] The USSR, like industrialized countries in the West, has achieved only a limited degree of substitution of other materials for tin in these applications.[7] Because of the large share of machinery products allocated to military and space programs (about 30% of the total compared with about 10% in the United States), national security considerations probably loom large in the USSR's determination not to rely primarily on foreign sources for tin.

Imports

26. From 1965 through 1975, annual imports averaged about 7,000 tons, regularly accounting for 20%-30% of Soviet consumption of primary tin. In 1975 they totaled 9,900 tons (see Table 5).

27. The USSR imports most of its tin from Malaysia, Bolivia, and the United Kingdom (see Table 6). Tin is obtained in the United Kingdom by spot purchases on the London Metal Exchange, while deliveries of tin from Malaysia and

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[6] Solders, low melting alloys of lead and tin, are used mainly as joining materials in the automotive and electrical industries. Babbitts (tin combined with antimony and other metals) are extensively used as antifriction devices in assorted machinery. Bronzes (copper-tin alloys) and brasses (copper-zinc alloys)—in many instances small amounts of tin are added to enhance anticorrosive properties—are used in many varieties of machinery and machined parts.

[7] Aluminum alloys, other copper-base alloys, and plastics can be substituted for bronzes and brasses, and low-tin aluminum-, copper-, or lead-base bearing alloys and roller or ball bearings may be substituted for babbitt metal, but no satisfactory substitutes have been found for solder, by far the largest and most important tin consumer among the applications prevalent in the Soviet Union. The Soviets probably are doing some substitution, given the relative costs indicated in Table 2, but the degree is not clear from the literature.

Table 5

Soviet Imports of Tin[1] and Related Costs

	Imports (Thousand Metric Tons)	Costs (Thousand US $)	Average Cost per Metric Ton (Thousand US $)
1965	5.8	21,200	3.7
1966	4.8	16,100	3.4
1967	5.7	18,400	3.2
1968	7.1	21.600	3.0
1969	6.8	22,800	3.4
1970	9.0	32,200	3.6
1971	6.3	20,600	3.3
1972	4.4	15,300	3.5
1973	6.9	28,800	4.2
1974	6.6	47,700	7.2
1975	9.9	66,400	6.7

1. Including concentrates.

Bolivia are arranged by means of short-term contracts. Tin obtained from Bolivia is mainly in the form of concentrates which are processed and refined in the USSR. In the 1950s and early 1960s China was the USSR's principal supplier, but in the last decade its annual deliveries have averaged only about 300 tons. North Vietnam also supplies small amounts of tin.

Table 6

Soviet Imports of Tin, by Source[1]

Metric Tons

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Total	**5,800**	**4,800**	**5,740**	**7,100**	**6,800**	**9,016**	**6,333**	**4,362**	**6,916**	**6,555**	**9,888**
Bolivia (metal)	....	....	....	....	....	302	1,082	661	601	772	1,720
Bolivia (tin-in-concentrates)	....	....	....	....	....	716	1,933	162	2,916	1,355	234
Indonesia	1,400	100	....	....	....	....	....	....	....	....	....
Malaysia	1,600	2,000	1,700	1,200	2,683	2,622	1,037	610	1,585	2,561	5,161
North Vietnam	45	60	40	20	....	....	14	123	64	139	76
People's Republic of China	500	500	100	300	30	200	500	800	501	500	....
United Kingdom	2,200	2,100	3,900	5,200	3,667	4,942	1,682	2,040	1,125	1,313	2,697
Residual[2]	55	40	....	380	420	234	85	-34	124	-85	....

1. Imports from Bolivia are shown both for tin metal and for the estimated tin content of concentrates. Imports from all other countries are of tin metal only.
2. The difference between total figures and the summation of figures for individual countries reported in ***Vneshnyaya Torgovlya SSSR***.

28. With the upward surge in the world tin prices in 1974, Soviet payments to the three Western suppliers reached $46 million, nearly twice the amount paid in 1973, even though the volume of imports remained about the same. Although tin prices eased in 1975, increased imports resulted in further growth in hard currency payments to about $66 million.

29. Since 1971 the USSR has been a member of the International Tin Council, an organization made up of tin-producing and tin-consuming countries.[8] The USSR, although one of the world's largest producers of tin, participates in the council as a consumer nation because of its dependence on imports to meet a sizable part of its requirements.

Outlook

30. The USSR probably will continue to expand domestic output of tin even though such production is at a substantial cost disadvantage (see the ruble/dollar ratios in Table 2). Although economic considerations appear to favor decreased domestic production and increased imports, other considerations probably will induce the USSR to maintain the status quo, producing about 70%-80% and importing about 20%-30% of the tin it uses. The USSR obviously is concerned about becoming too dependent on foreign sources of supply and regards a high degree of self-sufficiency as desirable for national security. Moreover, Soviet planners are promoting development of the eastern regions of the country, and the presence of the tin industry throughout Siberia could provide a basis for general development in the area. Subsidizing the tin industry to achieve objectives of partial self-sufficiency and regional development probably will continue to seem a reasonable course of action, especially if current trends–i.e., steady increase in the international market price of tin and stabilized Soviet costs–continue. By 1980, annual domestic production of tin probably will have increased to about 35,000 tons, about three-fourths of the estimated Soviet requirement for about 45,000 tons in that year. This estimated 1980 requirement assumes that tin use will continue to increase at nearly the same rate experienced in the past decade. This assumption appears reasonable given the relatively low level of Soviet per capita consumption compared with that in other developed countries, the probable continued steady growth of the Soviet economy, a probable increase in the manufacture of tinplate to support

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[8] This organization has been in operation for 20 years, and, since the United States joined in 1976, membership has included all major producers and consumers of tin. Its division into consumer and producer groups (both having equal voting strength) constitutes another dichotomy between the developing countries–which compose the bulk of the producing group–and the industrialized nations, which make up most of the consumer group.

Soviet plans for expansion of the canning industry, continued use of relatively wasteful tin-plating technology, and limited avenues for tin substitution.

31. Most of the growth in Soviet tin output during 1976-80 will come from the expansion of operations at existing sites in southern Siberia. In Khabarovskiy Kray, the throughput of the concentrating facilities at the Solnechnyy facility will be increased when the two mines now under development are completed. An increase in output will also be realized in Primorskiy Kray when the Arsen'yev mine, which began production in 1975, is brought into full operation.

32. No major increase in production from new deposits is likely by 1980. Exploratory investigations were started in 1968 on promising offshore deposits in Van'kina Bay in the Yakutskaya ASSR. Results proved sufficiently encouraging to warrant establishment of a pilot plant in late 1975, after many delays in development work. It is not known yet whether the USSR plans to undertake construction of commercial scale facilities at Van'kina Bay. Another possible site for offshore mining is off Cape Billings in Magadan Oblast, but so far only exploratory drilling has been conducted.

33. The USSR is clearly interested in these offshore mining ventures in the extreme north as possible lower cost alternatives to permafrost operations. It has apparently postponed indefinitely plans formulated in the late 1960s to develop a lode deposit at Deputatskiy in the Yakutskaya ASSR. In Magadan Oblast, limited extraction has been carried out at the Pyrkakaj lode deposit, but construction of a concentration plant, which was proposed in 1968, has not yet begun. A new Soviet decision to go ahead with one or both of these onshore projects in all probability could yield no significant output until the 1980s.

34. The USSR is more likely to undertake development of new deposits elsewhere in the country. The promising deposit at Badzhal in Khabarovskiy Kray is being actively investigated but, even if its reserves prove to be substantial, they probably could not be developed during the current decade. Moscow has also announced that a new tin ore combine in Central Asia is envisioned, but no date has been mentioned. Here too, it is not likely that this deposit—which was discovered in 1964—will be ready for production during the 1970s.

APPENDIX

PRINCIPAL TIN FACILITIES IN THE USSR

Table A-1

USSR: Principal Tin Mines and Concentrating Plants

Geographic Area Name and Location	Type of Mine	Date of Initial Operation	Remarks
Northern Mining Regions			
Magadan Oblast			
Iul'tinsky Ore Mining Combine			
Iul'tin (67° 50' N. 178° 48' E.)	Lode	1954	The facility consists of a lode mine and concentrating plant. Tungsten concentrates are also produced here. Production has increased slowly in recent years.
Omsukchanskiy Tin Mining Combine			
Galimy (62° 20' N. 155° 59' E.)	Lode	1954	Tin mining output has grown slowly in recent years.
Pevek Mining and Concentrating Combine			
Pevek (69° 42' N. 170° 17' E.)	Placer and lode	Mid-1950s	One of the two largest tin mining and concentrating enterprises in the North. Output has changed little in recent years.
Yakutskaya ASSR			
Deputatskoye Mining Administration			
Deputatskiy (69° 18' N. 139° 54' E.)	Placer	Early 1950s	Large lode deposits have been discovered in the vicinity but have not been developed. Soviet sources anticipate that this will develop eventually into a highly economical and productive facility.
Ege-Khaya Ore Mining Combine			
Ege-Khaya (67° 31' N. 134° 40' E.)	Mostly lode	Early 1940s	The combine is composed of a few mines and a concentrating plant nearby in the town of Butagai.

Table A-1

USSR: Principal Tin Mines and Concentrating Plants (Continued)

Geographic Area Name and Location	Type of Mine	Date of Initial Operation	Remarks
Southern Mining Regions			
Khabarosvskiy Kray			
Khingan Tin Combine			
Obluch'ye (49° 00' N. 131° 05' E.)	Lode	1945	The combine has at least two mines and a concentrating plant. Recent prospecting has yielded discoveries of new tin deposits.
Solnechnyy Mining and Concentrating Combine			
Solnechnyy (50° 42' N. 136° 35' E.)	Lode	Early 1960s	The combine is the largest in the USSR. It is served by two concentrating plants in addition to several lode mines. It has been reported that this is the lowest cost tin mining operation in the USSR. In recent years much prospecting has been conducted, resulting in discoveries of new tin deposits.
Primorskiy Kray			
Dal'olovo Tin Combine			
Dal'niy (43° 00' N. 132° 57' E.)	Lode	Early-mid-1950s	
Khrustalnyy Mining and Concentrating Combine			
Kavalerovo (44° 16' N. 135° 51' E.)	Lode	Early-mid-1950s	The combine, consisting of a concentrating plant and several mines, is second only to Solnechnyy in mined tin production.
Sikhate-Alinskiy Polymetallic Combine			
Tetyukhe (44° 25' N. 135° 55' E.)	Lode	Early-mid-1950s	Several mines and at least one concentrating plant. Lead concentrates are also produced. Output of both tin and lead should increase because this area has been the focus of recent prospecting and discoveries.

Table A-1

Principal Tin Mines and Concentrating Plants
(Continued)

Geographic Area Name and Location	Type of Mine	Date of Initial Operation	Remarks
Chita Oblast			The mines in Chita Oblast were the principal source of tin in the USSR from 1935 to at least 1940, but now rank last.
Khapcheranginskiy Tin Combine Khapcheranga (49° 42' N. 112° 24' E.)	Lode	1934	The combine has several mines and a concentrating plant.
Ononskoye Mining Administration Olovyannoya (50° 56' N. 115° 35' E.)	Lode	1933	The oldest tin mining operation in the USSR.
Sherlovogorskiy Mining and Concentrating Combine Sherlovaya Gora (50° 34' N. 116° 15' E.)	Lode	1935	The combine has several mines and a concentrating plant.

Table A-2

USSR: Principal Tin Reduction Plants

Name and Location	Date of Initial Operation	Remarks
Novosibirsk Nonferrous Metals Plant Novosibirsk (54° 57' N. 82° 56' E.)	Mid-1940s	This is the major Soviet tin reduction facility. Crude tin ingots are obtained by smelting of concentrates. They are then refined by heating to the melting point of tin, which is below the melting point of many impurities. The molten tin is drawn off and further refined by boiling to get rid of additional impurities in gaseous form. "Super pure" tin is obtained at Novosibirsk by zone refining, a vacuum process in which the crude tin ingot is heated by induction in a narrow zone that advances slowly from one end of the ingot to the other, taking with it impurities which are cropped off at the end. Novosibirsk is the only Soviet tin reduction plant that uses the zone refining process.
Podol'sk Tin Plant Podol'sk (55° 25' N. 37° 34' E.)	1934	Construction of Podol'sk marked the beginning of the Soviet tin industry. Small-scale smelting and refining is done by conventional pyrometallurgical methods.

Table A-2

USSR: Principal Tin Reduction Plants
(Continued)

Name and Location	Date of Initial Operation	Remarks
Ryazan Tin Plant Ryazan (54° 35' N. 39° 46' E.)	Mid-1940s	Small-scale smelting and refining is done by conventional pyrometallurgical methods.